EDITORIAL ARTICLES.

OPERATIVE ATTACKS UPON THE HUMAN BRAIN.

1. Brain Surgery. By Victor Horsley, B.S.F.R.S. *British Medical Journal*, 1886, Oct. 9.
2. The Condition of the Bones of the Skull, and the Dura Mater in Cases of Tumour of the Brain. By W. Hale White, M.D. *Guy's Hospital Reports*, Vol. XLIII, 1886.
3. One Hundred Cases of Cerebral Tumour, with Reference to Cause, Operative Treatment, Mode of Death, and General Symptoms. By W. Hale White, M.D. *Guy's Hospital Reports*, Vol. XLIII, 1886.
4. Middle Meningeal Hæmorrhage. By W. H. A. Jacobson, M.D. *Guy's ospital Reports*, Vol. XLIII, 1886.

1. In the Section of Surgery at the recent annual meeting of the British Medical Association, Mr. Victor Horsley presented a communication in which he detailed three cases in which he had methodically attacked parts of the human brain by surgical procedures, removing portions that were the subjects of disease, being guided in the preliminary steps for exposing the affected parts by already established facts of cerebral localization.

The first case was that of a man, æt. 22, who, when 7 years old, had sustained a depressed comminuted fracture of the skull, with loss of brain substance, from which he had finally recovered after a history of free suppuration, hernia cerebri, and temporary hemiplegia. At about 15 years he began to have fits, which were very intermittent. With the lapse of time the number of fits, occurring in batches, had become enormous, as many as 3,000 having occurred during one fortnight shortly before being subjected to operation. These fits were almost always of the same character, usually commencing in the right lower limb, sometimes in both the right limbs simultaneously. The parts affected were in the order of lower limb, upper limb, face and neck ; the character of the movements was, first, extension, then confusion, finally flexion. From these phenomena it was inferred that the focus of discharge was situated around the posterior end of the superior frontal sulcus. The patient was distinctly hemiplegic, even ten days after the last fit, but he could perform all the movements of the right limbs, though about half as strongly as on the left side; there was no affection of sensation on the right side, while the reflexes, superficial and deep, were exaggerated in both the right limbs.

On the left side of the vertex of the head (the exact site as determined by measurement being the centre of the upper third of the ascending frontal convolution; that is posterior to the hinder end of the superior frontal sulcus) there was a quadradiate scar, opposite the centre of which the bone could be felt to be wanting, so as to form an oval opening in the skull, the long diameter of which was about one inch, and parallel to the sagittal suture. Pressure on this scar always gave pain, which was very greatly increased when the patient was suffering one of his paroxysms of fits.

Operation, May 25, 1886.—The bone around the old opening was freely removed; the dura mater, arachnoid, the skin being found to form a homogeneous mass of fibrous tissue; the former was raised with the flap. The scar in the brain was found to be highly vascular, of a deep red color, and about 3 centimetres long and 2 broad. The membrane covering the brain around appeared to be very opaque, and the brain of a slightly yellower tinge than usual. The scar, and about half a centimetre of surrounding brain-substance was excised to the depth of 2 centimetres. It was then found that the scar-tissue penetrated a few millimetres further into the corona radiata fibres of the marginal convolution. This portion was then removed, and the wound closed. In the removal of the mass, three fair-sized veins, coming directly from the middle of the area for the upper limb, had to be ligatured, since they passed directly into the scar. The wound completely healed in a week. The tension of serum was twice relieved (once, probably, unnecessarily). The most interesting point now to be recorded is, that after the operation the patient was at first completely paralysed in digits of the right upper limb; and for further flexion of the wrist and supination of the forearm. Coupled with this motor paralysis, there was loss of tactile sensibility over the dorsum of the two distal phalanges of the fingers. He could not localize the touch anywhere below the wrist within the distance of one internode; finally, he could not tell the position of any of the joints of the digits. Then we have here, apparently, a distinct instance of loss of tactile sensibility and muscular sense, coupled with motor paralysis, all due to lesion of the cortex. It cannot, however, be too clearly understood that it is very possible that some of the fibres coming from the gyrus fornicatus in the corona radiata may very probably have been injured. This condition of motor and sensory paralysis gradually disappeared in the course of the next two months. Up to the present time the patient has had no fits.

The SECOND CASE was likewise in the person of a young man,, æt. 20. In January, 1884, he began to have "cramps" in the left thumb and forefinger, these consisting of clonic opposition of the named digits, and occurring about twice a day for three months. The first severe fit occurred in March, 1884. Spasm spread up the arm, and the patient fell. He had the second in January, 1885. Then followed a series of remissions of the twitchings, until, in August, 1885, another severe fit inaugurated a series of fits, occurring once or twice a week until admission on December 4, 1885. The character of the fits was almost always the same. They began by clonic spasmodic opposition of the thumb and forefinger (left), the wrist next, and then the elbow and shoulder were flexed clonically, then the face twitched and the patient lost consciousness. The hand and eyes then turned to the left, and the left lower limb was drawn up. The right lower limb was next attacked, and finally the right upper limb. Paralysis of the left upper limb frequently followed a fit. At frequent intervals every day the patient's thumb would commence twitching, but progress of the convulsion could often be arrested by stretching the thumb or applying a ligature. Deep reflexes were exaggerated in the left upper limb. The patient frequently had severe headache, beginning at the occiput and shooting forward, especially to the parietal region. Experiments of the author having shown him that the movement of opposition of the thumb and finger can be elicited by minimal stimulation of the ascending frontal and parietal convolutions at the line of junction of their lower and middle thirds, it was believed that this patient was suffering from an irritative lesion of unknown nature situated in the part of the brain thus indicated. An exploratory operation was therefore decided upon.

Operation, June 22, 1886. The seat of the lesion having been determined by measurement, a large trephine was applied, and on raising the dura mater, a tumour came into view. More bone was removed above and in front, so as to completely expose the mass to which the dura mater was adherent. The border of the tumour stood out about one-eighth of an inch from the surface of the brain, and it was much denser than the brain substance. It appeared to be only half an inch broad, but as the brain substance all round it for more than half an inch appeared dusky and rather livid, the operator removed freely all the part apparently diseased. Before closing the wound the centre of the thumb area was removed by free incision, in order to prevent, as far as possible, recurrence of the epilepsy. Numerous vessels were ligatured.

The wound was closed. Five-sixths of it healed by the first intention in a week. The remaining sixth, just at the lower border of the flap, gave way and healed by granulation, after separation of a small piece of skin at the edge. The after-condition of the patient was most interesting and important. There was, next day, partial motor paralysis of the left side of the face (lower division), complete motor paralysis of the left upper limb, from and including the shoulder. On the 27th of June, there was noted left hemianæsthesia to a light touch (sensibility to pain unaltered), localization of a prick of a pin very deficient all over the left side, perfect on the right, complete loss of muscular sense in the left upper limb below the shoulder. On the second day after the operation, when making an effort to move the left upper limb, the patient suddenly put his hand to the wound, and said he felt a "buzzing" in the head there. When the left upper limb was passively moved, he also complained that pain seemed to shoot up the "bones of the limb," side of the neck, and through the hand to the wound. The deep reflexes were much exaggerated on the left side in both limbs. All the above conditions gradually improved, and at the date of meeting, the patient had regained everything, except that the grasp of the left hand was not quite so good as before and the fine movements of the fingers remained hampered. Further, the deep reflexes on the left side are at the present time still very much exaggerated. The patient had, in July, a few slight twitches in the three right fingers; none in the thumb or index; no fits since operation. The tumour was composed of dense fibrous tissue, with two caseated foci, microscopical examination proving it to be tubercular.

The THIRD CASE was still again in the person of a young man, æt. 24 years. When five years old, the shaft of a carriage fell on the vertex of the head, inflicting a wound and slight punctured fracture. When 13 years old, he was kicked by a horse on the same spot. Three months later the fits began. The fits occur usually in batches of three or four every three weeks.

The patient was a tall, powerful young man, with numerous scars about the head, due to falls, etc., when fits had occurred (he also had most of his teeth kicked out by horses when he had fallen down near them, his occupation being that of a stable-help). There was the scar and minute depression of a right depressed fracture in the upper anterior angle of the left parietal bone, close to the middle line. This scar and the scalp around were very tender to pressure. The patient frequently had intense headache at this point, always increased (with also the tenderness) when the tendency to fits came on. There was almost complete right hemianæsthesia, the patient neither feeling a touch, nor a prick with a pin. The application of a strong faradic current to the affected side, completely dispersed this hemianæthesia, but left the fits unaltered.

The aura was entirely abdominal. The patient had a feeling as if he were going to defæcate, accompanied sometimes by a sharp pain in the left side of his abdomen. This was followed by tightness in the throat, and sometimes a spasmodic cough. The head (and frequently the eyes) then turned to the right; the right arm was jerkily protruded, and the patient lost consciousness. All the limbs became affected, that is, powerfully flexed, as a rule; the lower limbs, however, being frequently extended. After the fit, the patient stated that the right arm felt weak for some time.

The site of the slight depression in the skull coincided with the location of the posterior third of the superior frontal convolution. The researches of the author and Professor Schäfer had already shown that the motor abdominal centres are just opposite the hinder end of the superior frontal sulcus. Professor Ferrier has also shown that the area for movement of the head and neck lies below this sulcus, and that the area for protrusion of the arm lies about the hinder end. The symptoms of the patient, therefore, as well as the site of the cicatrix pointed to an irritative lesion in the posterior third of the superior frontal convolution. The following exploratory operation was accordingly done:

Operation, July 13th, 1886.—A flap being raised from the skull, and the bone trephined close to the left depression, it was found that there had been splintering of the inner table, so as to form a rough coronet round the inner orifice of the minute puncture of the skull, the said puncture being filled with scar-tissue. Further, the dura mater was found to have been torn by the original injury, and projecting downward into a cavity in the brain was a rough small plate of bone. These fragments being removed, and the dura mater freely opened, the cavity just mentioned was found to be wedge-shaped, and about one to five centimetres broad, filled with fluid and loose connective tissue. It was situated exactly where diagnosed (*vide supra*). By means of a circumscribing cut, at a distance of about five millimetres, the cavity was then removed.

The wound was completely healed in four days. One week after the operation, the patient complained of weakness in the whole right upper limb. All movements were affected, especially those of the hand. This paresis is extremely interesting, as being, without the slightest doubt, an example of male hysterical paralysis, and its connection with the functional anæthesia before the operation is obvious. The interval of six or seven days before its appearance exactly coincides with that given recently by Professor Charcot. This paresis had, at the date of the meeting, practically disappeared.

REMARKS ON OPERATIVE TECHNIQUE. Mr. Horsley attributes much of his succes in overcoming the difficulties and dangers of his operations, and in conducting his patients to such rapid recovery to the details of his operative technique, which are as follows:

Preparation of the Patient.—The day before the operation, the patient's head is shaved and washed with soft soap and then ether; next the position of the lesion is ascertained by measurement, and marked on the scalp. The head is then covered with lint, soaked in 1 in 20 solution of carbolic acid, oil-silk and cotton-wool, being thus thoroughly carbolized for at least twelve hours before operation. Finally, the patient has the usual purgative administered the evening before, followed by an enema on the morning of the operation.

Anæsthetic.—The method of narcotizing the patient is most important, and consists of the administration, by hypodermic injection, of a quarter of a grain of morphine, after which the patient is chloroformed. The object in giving the morphine is two-fold. In the first place, as is well known, it allows of the performance of a prolonged operation, without the necessity of giving a large amount of chloroform. In fact, the amount actually used in an operation lasting two hours has been very small. The second reason for employing morphine is, perhaps, the more important, since it is based upon the fact determined by Professor Schäfer,and the author from experiments on monkeys–namely, that this drug causes well-marked contraction of the arterioles of the central nervous system; and that, consequently, an incision into the brain is accompanied by very little oozing if the patient be under its influence. Ether has not been employed in operations on men, from the fear that it would tend to cause cerebral excitement; chloroform, of course, producing, on the contrary, well marked depression. Naturally,if there existed any heart-complication, the above theoretical considerations would be disregarded in favor of the safer narcotic.

Treatment of the Wound.—The author believes that the high mortality, which has followed the operation of trephining heretofore, has been caused by septic meningitis coming on after opening the dura mater. He, therefore, has been impelled in his operations to adopt strict Listerian methods, including the use of the carbolic spray, 1 in 20 carbolic lotion, and dressings of carbolic gauze.

Line of Incision.—It is the general custom to remove the soft parts from the cranium by means of a cruciform cut. This method is practically inconvenient, since four distinct flaps have to be held back, requiring as many assisting hands, all very much in the way. If, on the contrary, a semi-lunar flap be raised, it can be simply thrown back, and requires no more holding; 1. The incision must be carried vertically to the bone, and all parts superficial to the periosteum raised with the flaps. 2. The curve must be a shallow one, to avoid cutting collateral vessels. 3. It must be so drawn as not to divide the main arterial trunks supplying that portion of the scalp. (This can be very easily done without interfering with the first twenty-four hours' drainage of the wound, even if the flap be turned downwards, since, as the patient lies in a supine position, the discharge can always escape freely from the posterior border). The periosteum should be reflected by a crucial incision from an area corresponding to the first trephine-hole, and subsequently as more bone is cut away.

Removal of the Bone.—One of the safest and most rapid methods is to make a couple of trephine-holes at the opposite extremities of the area to be removed, then to half cut through the sides of such an area with a Hey's saw, and, finally, to complete the division with a powerful bone-forceps. The opening of the skull should be commenced by the removal of a large disc with the trephine, and then the dura mater separated as far as possible from the under surface of the bone to be removed. Where it is possible to preserve the dura mater intact, the portions of the bone removed should be preserved in warm aseptic sponges, and, at the end of the operation, should be placed between the skin and dura mater, after having been divided into small fragments.

Treatment of the Dura Mater.—The dura mater should be incised round four-fifth of the circumference of the area exposed at one-eighth inch distance from the edge of the bone, so as to render it possible to stitch the edges together afterwards. The dura mater is best opened first by incision with the scalpel, and then by blunt-pointed curved scissors, great care being taken not to wound the meninges beneath. The main branches of the middle meningeal artery are best secured by a ligature passed through the dura mater just outside its cut edge, and knotted before the vessel is divided.

Treatment of the Brain.—The first practical point to notice after the division of the dura, is whether the brain immediately bulges into the trephine-hole or not. The experience of the author inclines him to the belief that the fact of the brain bulging very prominently into the wound, indicates pathological intra-cranial tension—a piece of evidence which, if true, is of the highest importance, since, other things being equal, it will indicate the presence of a tumour. The color of the membranes should next be noted, since the existence of a slight yellowish tinge, or, possibly, the contrary condition, namely lividity, will indicate the existence of a tumour beneath the cortex in the corona radiata. An accurate knowledge of the arterial and venous supply of the brain is highly necessary, to enable one to appreciate what portions of the brain are actually, or likely to be, deprived of their blood supply when portions of the brains are removed. Alterations in the density of the brain must likewise be observed, though it must be remembered that cerebral tumours situated beneath the cortex are scarcely to be detected, save by exploratory incision.

Hæmorrhage from incisions into the brain, though heretofore greatly feared, is easily controlled. The actual cautery is unnecessary and objectionable. The free bleeding, which at first follows an incision, will permanently cease if the wound be plugged for a few minutes with a piece of sponge. Much of the hæmorrhage may be guarded against by the previous administration of morphine. Considering the terminal character of the cerebral arteries, every main vessel should be left intact, where possible. Fortunately, owing to their running into the pia mater, they can be raised from the brain, and especially out of the sulci, so as to allow of the subjacent brain being removed, while, at the same time, the vessel wall is so little damaged that any resultant thrombosis will be of a very temporary nature.

Further, in incising the brain, the cuts in the cortex must be made exactly vertically to the surface, and directed into the corona radiata, where necessary, in such a manner as to avoid damage of the fibres coming from the portions of cortex, and surrounding the seat of operation. This, of course, is easily done by remembering the paths taken by the fibres from the cortex to the internal capsule. There are many other points connected with the physiology and pathology of the brain which will regulate operative treatment of the same, such, for instance, as the taking care to leave, if possible, portions of each centre, so that the representations of the movements of any particular joint may never be totally destroyed, for total destruction means obviously a permanent paralysis on the opposite side of the movements previously regulated by the cortical centre.

A portion of brain removed, whether normal or abnormal, does not leave, as might have been supposed, a permanent gap with vertical sides, for, even in a very short time, the floor of the pit—that is, the corona radiata—bulges almost to a level with the surrounding cortex. In addition, the cut edges become slightly everted, and if less brain than bone is removed, they are extruded into the opening in the skull. Thus, owing to the mechanical relations between the brain and skull, there is, normally, a tendency to hernia cerebri. Hernia cerebri can only occur when the reflected flap of scalp has not united by the first intention, a further necessary factor being decomposition in the wound, and conversion of the latter into a suppurating cavity.

The advantage of raising a large flap of scalp, which can be laid down again like the lid of a box, will now be obvious, since, being continuous throughout, it offers plenty of resistance to the upward pushing brain, which the point of meeting of four cross cuts can never do; this, indeed, on the contrary, favoring the very thing one wishes to avoid. The principal resistance to this hernial protrusion of the normal brain is, of course, supplied in other ways. (See Drainage and Dressing, below).

Closure of the Wound.—All oozing, etc., having been made to cease by gentle pressure with a soft sponge, the flap must be laid down and secured with medium silk sutures at distances of one centimetre, and between these, horsehairs.

With the closure of the wound, we are brought to consider the important question of drainage. The conditions of the problem that now engage attention are to secure union by first intention—that is, firm union in four or five days, together with pressure upon the brain which tends to extrude. In addition to this, it is desirable to arrange matters so that, when the wound is finally healed, the flap of skin may be separated from the brain beneath by a cushion of soft normal (that is, non-inflammatory) connective tissue. All these latter conditions are to be obtained by allowing a certain amount of tension of wound-exudation within the cavity. During the first twenty-four hours, there is a steady oozing of blood and serous fluid from the cut surfaces. This is best removed; and, therefore, a drainage tube should be put in at the most dependent point of incision (that is, as the patient lies in bed). This tube is to be taken out the next day, and the wound carefully dressed, firm, but gentle, pressure being made over the centre ot the flap. If the wound-exudation that subsequently collects in the cavity, accumulates to any appreciable extent, on the third day the patient may complain of some pain and throbbing in the wound, which, when exposed, will be found to be distended in the centre, the periphery being firmly united. Now comes a most difficult point in the treatment—namely, the question whether this tension is to be allowed to proceed, or whether it should be released. By adopting the latter measure, the advantages of the pressure will be lost; so that the point in question is one requiring special attention. The practical feature upon which it is to be decided is the very simple one whether the primary union is in danger of being broken down by the pressure or not. If the former is the case, the pressure can easily be diminished by gently opening up the track of the drainage-tube with a probe, and liberating some of the exudation. The value of the tension in reducing the tendency to hernial protrusion is obvious; but it should be remembered that, until it is finally absorbed, the heightened pressure serves two purposes. In the first place, it compels the lymphatics of the brain meninges to absorb the fluid, just as the peritoneal vessels do after ovariotomy, so admitting of rapid union of the whole skin-wound; and, in the second place, it acts as a kind of scaffold for the building up of normal connective tissue in the part. This latter point is very obvious in the lower animals, in which, if the wound be reopened at the end of a few days, the cavity is always found filled with a delicate, spongy pink connective tissue, the meshes of which contain the above mentioned wound-exudation. It is this connective tissue which is to form an elastic barrier between the scalp and the brain. As a general rule, it will never be necessary to do more than relieve the tension in the wound once. At the end of a week or five days, the wound may be lightly covered with a little powdered boracic acid, cotton-wool, and collodion; and the stitches may be removed at any time after the first week. It will always be found that the scalp tends to fall in a little at the seat of operation; but, if the foregoing directions have been faithfully followed out, the hollowing will be slight.

It may be considered as a point of practical importance whether a patient will not run considerable risk in pursuing his avocations with a large gap or gaps in his skull. As a matter of fact, this is of little account, as evidenced by experience.

2 and 3.—In the first of these papers, Dr. White records the results of his examination of the bony envelope of the brain in cases where tumours have been present, and he has found that that portion of the bone over the region of the new growth is considerably thinned, often so that it is no thicker than cardboard. The dura mater is usually thicker than normal at these points, and this he ascribes to an inflammatory action. The condition of the bones is particularly interesting to those surgeons who still use the straight instead of the conical trephine, depending upon an occasional probing of the incision to determine the depth to which the instrument has penetrated, for if this condition is present they are apt to find that they have perforated the bone and injured the already inflamed dura mater. With the conical trephine the condition can have but little effect as that instrument cannot be driven on after the bone is cut through without causing a fracture.

The second paper is of much greater practical importance, inasmuch as the one hundred cases examined have been carefully tabulated and the number capable of being relieved by operative measures culled from those where any interference would have been useless if not positively harmful.

In forty-five of the cases the growth was tubercular and only seven of these were capable of being relieved by the knife. It is, of course, a question whether any of them should require the care of a surgeon, and Dr. White has taken the precaution to state his views, as adduced from the examination of the cases under discussion in the following terms:

1st. "The mass occupied some vital part."

2nd. "It was quite or almost inaccessible, as when it was at the base of the brain."

3rd. In all the cases one or more other structures were affected. "We may take it for granted that no one would like to operate on cases in which more than two other organs were diseased."

Twenty-four cases were glioma, of which number only six were suitable for operation.

Sarcoma existed in ten instances, one of which might have been reached and removed. Five were carcinoma, none of them being capable of relief owing to the existence of another infected centre in the body, and the author adds, "considering that cancer of the brain is infinitely rare except when secondary to a growth elsewhere it is obvious that surgical interference will never be needed."

Gummata existed in five cases and, of course, these are included in the number that do not require any surgical attention, as they usually absorb quite rapidly when iodide of potassium is administered in large doses. The author does not state what is generally regarded a large dose of the iodide at Guy's Hospital, and this is a matter of some regret, especially since the matter is under debate, and does not seem to be any nearer settlement than it was some time ago.

Cysts existed in four cases, and one of them could have been reached by the surgeon. Doubtful tumors are classed as three, and two of them are stated as operable.

"Thus it is seen that out of the total number of one hundred, only ten might certainly have been operated upon, and four additional ones might possibly have been, so that in ten per cent. of our cases, we can hold out some hope of operative relief to our patients, provided, that a correct diagnosis of the position of the growth be made."

This is surely not a very promising showing for the advocates of the most advanced operative procedues in cerebral surgery. The paper is full of interesting and instructive points, and well deserves a careful perusal.

4. As collateral to the question of Cerebral Surgery, from the standpoint presented in the foregoing papers, the Surgery of Middle Meningeal Hæmorrhage is of interest, and is exhaustively treated in the paper by Dr. H. A. Jacobson. The writer has collated a large number of cases in which this complication has resulted after an injury of more or less severity.

The conclusions drawn from this study are, in his opinion, similar to those already advanced by other writers, namely, that trephining should be resorted to as early as possible.

He says that the violence causing the extravasation is often very slight, and may exist without any fracture, or when the bone is simply fissured, or only the internal table is involved; that laceration and contusion of the brain substance are often serious complications; that the history of the case, particularly a lucid interval, are invaluable; that the symptoms of compression are sometimes deferred, and then may appear suddenly, and rapidly cause death; that, as in the cases of tumor of the brain, death frequently, if not usually, results from failure of respiration; that dilatation of the pupil on the side of the clot is an important symptom; and after trephining, a severe, if not fatal, hæmorrhage may set in. He recommends, in dealing with the last condition, that an attempt be made, first, to secure the bleeding point, if this fail, second, he applies a freezing mixture over the dressing, and raises the patient to the sitting position, and, third, if the bleeding still continues, digital compression over the common carotid artery should be made, and in case this hæmorrhage is re-established, after this has been continued for some time, he advises the ligation of the external carotid.

These three papers present the subject of Cerebral Surgery in a very striking and convincing way, and must surely do much to place the operative interferences with lesions, or injuries with the cranial cavity in a better position than before. With the usual impetuosity and enthusiasm of pioneers in any undertaking, the advocates of operative procedure in cases of this kind, have advised the most radical measures, and the collection of numbers of cases together with a careful tabulation of results, and the possibilities revealed to the careful pathologist, must greatly improve the principles of this branch of surgery.

The writer is able, however, to present only thirteen successful cases out of the seventy upon which his paper is based, which he considers but a poor showing. We feel inclined to take exception to the last statement, for surely eighteen and a half per cent. is a good showing in cases that would without operation have been surely fatal.

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